

What is claimed is:

1. A regulator control assembly for use in a second-stage regulator having a pressure-sensitive valve for coupling and decoupling a single air supply line with a SCBA facepiece, comprising:
  - a mechanical actuator sub-assembly; and
  - an electromechanical actuator sub-assembly;
  - wherein said mechanical actuator sub-assembly and said electromechanical actuator sub-assembly are each adapted to actuate the pressure-sensitive valve.
2. A regulator control assembly according to claim 1, wherein said electromechanical actuator sub-assembly includes a programmable microprocessor.
3. A regulator control assembly according to claim 2, wherein said electromechanical actuator sub-assembly includes means for sensing pressure in the facepiece and providing a signal to said microprocessor that varies as a function of changes in said pressure.
4. A regulator control assembly according to claim 3, wherein said means for sensing a pressure includes a pressure transducer.
5. A regulator control assembly according to claim 1, wherein said electromechanical actuator sub-assembly includes a piezoelectric actuator.
6. A regulator control assembly for use in a second-stage regulator, comprising:
  - a pilot chamber;
  - a single air supply line used to supply air to a SCBA facepiece;
  - a mechanical actuator sub-assembly for depressurizing the pilot chamber; and
  - an electromechanical actuator sub-assembly for depressurizing the pilot chamber.
7. A regulator control assembly according to claim 6, wherein said electromechanical actuator sub-assembly includes a programmable microprocessor.

8. A regulator control assembly according to claim 7, wherein said electromechanical actuator sub-assembly includes means for sensing pressure in the facepiece and providing a signal to said microprocessor that varies as a function of changes in said pressure.
9. A regulator control assembly according to claim 8, wherein said means for sensing pressure includes a pressure transducer.
10. A regulator control assembly according to claim 6, wherein said electromechanical actuator sub-assembly includes a piezoelectric actuator.
11. A regulator control assembly for use in a second-stage regulator having a pressure-sensitive valve controlling a single air supply line, comprising:  
first means for actuating the pressure-sensitive valve, said first means including a mechanically actuated element; and  
second means for actuating the pressure-sensitive valve, said second means including an electromechanically actuated element.
12. A regulator control assembly according to claim 11, wherein said second means includes a programmable microprocessor.
13. A regulator control assembly according to claim 11, wherein said second means includes a piezoelectric actuator.
14. A method of controlling a second-stage regulator single air supply line used to supply air to a SCBA facepiece using both mechanical and electromechanical actuators, comprising the steps of:  
providing a mechanical actuator for controlling the single air supply line;  
determining the pressure in the facepiece;  
determining the rate of pressure change in the facepiece;  
comparing the pressure in the facepiece to a predetermined pressure;  
comparing the rate of pressure change in the facepiece to a predetermined rate of pressure change;  
activating or deactivating the electromechanical actuator if the pressure in the facepiece is lower than the predetermined pressure; and

activating or deactivating the electromechanical actuator if the rate of pressure change in the facepiece is higher than the predetermined rate of pressure change.

15. A method according to claim 14, wherein said comparing steps are performed using a programmable microprocessor.

16. A method of modifying a second-stage regulator having a pilot chamber and a mechanically controlled single air supply line for supplying air to a SCBA facepiece to allow for electromechanical control of the single air supply line, comprising the steps of:

- adding an orifice to the pilot chamber;
- providing an electronically controlled actuator for sealing and unsealing said orifice;
- adding means for sensing the pressure inside the facepiece; and
- adding control means for activating and deactivating said electronically controlled actuator based at least partially on the pressure inside the facepiece.

17. A regulator control assembly for use in a second-stage regulator having a pressure-sensitive valve controlling a single air supply line for supplying air to a SCBA facepiece, comprising:

- an electromechanical actuator sub-assembly adapted to actuate the pressure-sensitive valve, wherein the regulator control assembly has no mechanical actuator sub-assembly.

18. A regulator control assembly according to claim 17, wherein said electromechanical actuator sub-assembly includes a programmable microprocessor.

19. A regulator control assembly according to claim 18, wherein said electromechanical actuator sub-assembly includes means for sensing pressure in the facepiece and providing a signal to said microprocessor that varies as a function of changes in said pressure.

20. A regulator control assembly according to claim 19, wherein said means for sensing pressure includes a pressure transducer.

21. A regulator control assembly according to claim 17, wherein said electromechanical actuator sub-assembly includes a piezoelectric actuator.

22. A regulator control assembly for use in a second-stage regulator having a pilot chamber and a single air supply line for supplying air to a SCBA facepiece, comprising:  
an electromechanical actuator sub-assembly for depressurizing the pilot chamber,  
wherein the regulator control assembly has no mechanical actuator sub-assembly.
23. A regulator control assembly according to claim 22, wherein said electromechanical actuator sub-assembly includes a programmable microprocessor.
24. A regulator control assembly according to claim 23, wherein said electromechanical actuator sub-assembly includes means for sensing pressure in the facepiece and providing a signal to said microprocessor that varies as a function of changes in said pressure.
25. A regulator control assembly according to claim 24, wherein said means for sensing pressure includes a pressure transducer.
26. A regulator control assembly according to claim 22, wherein said electromechanical actuator sub-assembly includes a piezoelectric actuator.
27. A method of controlling a second-stage regulator single air supply line used to supply air to a SCBA facepiece using only an electromechanical actuator, comprising the steps of:  
determining the facepiece pressure;  
determining the rate of facepiece pressure change;  
determining the actual electromechanical actuator voltage;  
finding the difference between said facepiece pressure and a predetermined desired facepiece pressure to obtain an error signal;  
multiplying said error signal by a fixed gain to obtain a proportional error signal;  
inverting and multiplying said facepiece rate of pressure change by a predetermined constant to obtain an output; and  
adding said proportional error signal to said output from said inverting and multiplying step to obtain a desired electromechanical actuator voltage;  
charging or discharging the electromechanical actuator if said actual electromechanical actuator voltage is lower than said desired electromechanical voltage; and  
charging or discharging the electromechanical actuator if said actual electromechanical actuator voltage is higher than said desired electromechanical voltage.

28. A method according to claim 27, wherein said comparing steps are performed by a programmable microprocessor.
29. A method according to claim 27, wherein said determining the pressure step includes using means for sensing a pressure in the facepiece.
30. A method according to claim 29, wherein said means for sensing a pressure includes a pressure transducer.
31. A method according to claim 27, wherein the electromechanical actuator is a piezoelectric actuator.